

Remarks

Claims 1-17 are pending. Favorable reconsideration is respectfully requested.

Applicants wish to express their appreciation to Examiner Gallagher for pointing out the discrepancy in the language of claim 1 relative to the use of vinyl "acetate" rather than vinyl "ester" in line 3 of claim 1. This inadvertent mistake was promulgated due to the fact that the preferred copolymers employ vinyl acetate as the $T_g > 0$ vinyl ester. Applicants have amended the claim to correct this error, and also to clearly indicate, as provided in lines 11-12 of page 2 of the specification, that the copolymer is free of alkyl acrylates.

New claims 11-17 have been added to more particularly point out and distinctly claim preferred embodiments of Applicants' invention. Support may be found on page 6, first paragraph; page 3, last paragraph; page 4, first paragraph; and in the Examples. Thus, no issue of new matter is raised by virtue of these amendments. The amendment at the end of claim 1 with respect to alkyl (meth)acrylates is entirely consistent with the scope of claim 1 as filed in the priority document under the doctrine of central claiming and thus this is not a narrowing amendment with respect to the *Festo* decision.

The present invention pertains to emulsion polymerized vinyl ester-ethylene copolymers further containing carboxylic acid groups which have good tack and cohesive strength while avoiding the use of alkyl acrylates which are ordinarily employed. Applicants have discovered that alkyl acrylate-derived moieties hydrolyze under basic conditions and slowly liberate the alkanol of the alkyl acrylate or alkyl methacrylate over the course of time. Such VOC emissions are considered environmentally undesirable. Applicants solved this problem by replacing the alkyl acrylate esters commonly employed in tacky adhesives with a mixture of vinyl esters, one being a vinyl ester monomer whose homopolymer has a $T_g > 0^\circ\text{C}$, preferably vinyl acetate; and the second being a vinyl ester monomer whose homopolymer has a $T_g < 0^\circ\text{C}$, preferably vinyl esters of α -branched C_{10} and/or C_{11} carboxylic acids.

The beneficial effects of the invention can be seen from the table on page 17, where the copolymers of Examples 1-10 have, in general, both higher tack as well as greatly enhanced cohesive strength as compared to comparable vinyl acetate-ethylene copolymers (Comparative Examples C11-C12), and comparable to vinyl acetate-ethylene-(2-ethylhexylacrylate) copolymers employed by the prior art (Comparative Examples C13-C15). However, the latter exhibit a high level of alkanol emissions (2-ethylhexanol) following use. *See*, in this regard, page 16, lines 6-20.

Claims 1-8 have been rejected under 35 U.S.C. § 103(a) over any of Midgley U.S. Patent 4,540,739 ("*Midgley*"), Graham U.S. Patent 4,714,728 ("*Graham*"), or Yoshii U.S. Patent 5,569,703 ("*Yoshii*"), all in view of Mao U.S. Patent 6,084,024 ("*Mao*"). The European equivalent of *Mao* was discussed in the application specification on page 2, lines 19-22.

Applicants respectfully submit that there is no motivation for the skilled artisan to combine *Mao* with any of the primary references, and that even if combined, the combination does not teach or suggest the subject invention. It should also be noted that none of the references discuss the problem addressed by Applicants: preparation of tacky vinyl ester-ethylene adhesives without employing alkyl acrylates so as to minimize alcohol emissions. It is well established that the problem solved is highly relevant in determining patentability. *In re Shaffer*, 108 U.S.P.Q. 326 (C.C.P.A. 1956); *Ex parte Breidt*, 161 U.S.P.Q. 767 (P.O.B.A. 1968); *In re Linnert*, 135 U.S.P.Q. 307 (C.C.P.A. 1962).

Midgley discloses a process for improving the shear properties of aqueous pressure sensitive adhesives ("PSA") by including a carboxylic acid monomer and then reacting the carboxylic acid groups with a strong, alkali metal hydroxide base. *Midgley* discloses three distinct classes of polymers. While all three classes are relevant to the question of obviousness, as discussed below, class (c) is most relevant to the claimed adhesives. These polymers include (c)(i) a C₂₋₄ olefin, i.e. ethylene, in an amount of 1-40 weight percent; (c)(ii) from 60-99.5 weight percent of a vinyl ester or an alkyl ester of an unsaturated C₃₋₁₂ carboxylic

acid (i.e. an alkyl (meth)acrylate) (column 3, lines 32-34);¹ and (c)(iii) 0.5 to 40 weight percent of an ethylenically unsaturated carboxylic acid. Following preparation of the base polymer, the carboxylic acid groups are neutralized by addition of strong base.

The preferred monomers (c)(ii) are vinyl acetate, vinyl propionate, or vinyl butyrate (column 5, lines 64-65) while the preferred alkyl unsaturated carboxylic esters are acrylate and methacrylate esters. The only examples of PSA in the *Midgley* application are styrene-butadiene-itaconic acid copolymers (column 8, lines 33-end, Table I) and alkyl acrylate-based adhesives (column 9, lines 6-24, Table II).

The subject invention polymers are not neutralized with base, as is clear from the specification and examples. Claim 1 has been amended to recite that the vinyl ester-ethylene copolymer contains free carboxylic acid groups to make this clear. Applicants do not believe that *Midgley* is pertinent to the claimed copolymers for this reason.

Moreover, *Midgley* does not teach or suggest that two very different vinyl esters be used, one with a homopolymeric $T_g > 0$ (i.e. vinyl acetate, vinyl propionate, vinyl butyrate) and one with a homopolymeric $T_g < 0$ (i.e. certain C_8 and higher vinyl esters). *Midgley* also shows no preference for vinyl esters over alkyl acrylates, and completely fails to discuss the problem solved by Applicants.

Mao teaches the preparation of aqueous-based PSA rather than solvent-borne PSA. It is the avoidance of organic solvents which *Mao* seeks to avoid. *Mao* does not mention the subsequent generation of volatile alkanols by hydrolysis over time, following use of the adhesives. To avoid the use of solvents, *Mao* teaches that PSA containing vinyl acetate as a comonomer with ethylene be improved by eliminating the vinyl acetate and substituting instead a C_{8-13} neoacid vinyl ester. The PSA of *Mao* contain 5-40% C_{8-13} neoacid vinyl ester; 30-80% C_{1-12} (meth)acrylate esters; and optionally up to 20% of saturated aliphatic vinyl

¹ It is noted that since the polymers must contain at least 1% olefin and 0.5% unsaturated carboxylic acid, the upper limit of vinyl ester cannot be 99.5%.

esters, i.e. vinyl acetate. Addition of unsaturated carboxylic acids (component (h); column 4, lines 12-13) is also optional.

It should be noted that the alkyl (meth)acrylate comonomer is a necessary component, and is used in large amount (30-80%). *Mao* also discloses that addition of as much as 5% of vinyl acetate gives a dramatic drop in PSA properties (Example 8, column 9; column 11, lines 1-5).

Applicants find no motivation to combine *Midgley* with *Mao*. The CAFC has recently addressed, several times, the evidence necessary to support motivation to combine references. In the case of *In re Anita Dembiczak* and *Benson Zinbarg*, 50 U.S.P.Q.2d 1614 (Fed. Cir. 1999), the CAFC has indicated that the requirement for showing the teaching or motivation to combine references is "rigorous." *Dembiczak* at 1617. Moreover, this showing, which is rigorously required, must be "clear and particular." *Dembiczak* at 1617. See also, *C.R. Bard v. M3 Sys., Inc.*, 48 U.S.P.Q.2d 1225, 1232 (Fed. Cir. 1998). It is well established that merely because references can be combined, the mere suitability for logical combination does not provide motivation for the combination. See, *Berghauser v. Dann, Comr. Pats.*, 204 U.S.P.Q. 398 (DCDC 1979); *ACS Hospital Systems, Inc. v. Montefiore Hospital*, 221 U.S.P.Q. 929 (Fed. Cir. 1984). Moreover, mere conclusory statements supporting the proposed combination, standing alone are not "evidence". *McElmurry v. Arkansas Power & Light Co.*, 27 U.S.P.Q.2d 1129, 1131 (Fed. Cir. 1993). See also *Ecolchem, Inc. v. Southern Cal. Edison Co.*, 56 USPQ2d 1065 (Fed. Cir. 2000); and in particular, *In re Lee*, 61 USPQ2d 1430 (Fed. Cir. 2002).

Here, *Midgley* is directed to increasing cohesiveness of a PSA by neutralizing free carboxylic acid groups with alkali metal hydroxide. The relevant *Midgley* polymers, prior to neutralization, contain olefin (ethylene), vinyl ester (vinyl acetate), and unsaturated carboxylic acid ((meth)acrylic acid) derived comonomer units. By contrast, those of *Mao* contain C₈₋₁₃ neoacid vinyl esters, significant alkyl acrylates (30-80%), and only optionally vinyl acetate and unsaturated carboxylic acid. The polymers are quite different. *Midgley* teaches neutralization of free carboxylic acid groups of his polymers with base. However, the

majority of the polymers disclosed by *Mao* contain no carboxylic acid. Unsaturated carboxylic acid monomers are an optional component. Finally, one skilled in the art would not be motivated to add a strong base to *Mao*'s polymers, since to do so would hydrolyze the alkyl acrylate and produce a polymer which releases additional alkanol over time, just what the present invention avoids. In the absence of motivation to combine these references, the rejection over *Midgley* in view of *Mao* must be withdrawn.

Even if combined, however, the combination does not teach or suggest the subject invention adhesives. It is well established that when references are properly combinable, isolated teachings may not be culled from the individual references while ignoring the remaining teachings. *In re Wesslau*, 147 U.S.P.Q. 391, 393 (C.C.P.A. 1965). Even when a claimed product is within the broad field of the prior art and one might arrive at it by selecting specific items and conditions, the product is not obvious in the absence of some directions or reasons for making the selections. *Ex parte Kuhn*, 132 U.S.P.Q. 359 (P.O.B.A. 1961).

The Office's position is, as Applicants understand it, that one skilled in the art, viewing *Midgley*, would be motivated to employ higher vinyl esters (i.e. C₈₋₁₃ neoacid vinyl esters) in *Midgley*'s formulation. However, first *Mao* does not teach or suggest that such higher vinyl esters should be used in a composition such as that of *Midgley*. Rather, *Mao* employs such esters in conjunction with much larger quantities of alkyl acrylates (30-80%). These are the very monomers Applicants seek to avoid.

Second, there is no suggestion, either in *Midgley* or in *Mao*, that the vinyl ester portion of the polymer comprise two distinct vinyl esters, one which has a homopolymer Tg > 0°C (i.e. vinyl acetate), while the other has a homopolymer Tg < 0°C, i.e. certain higher alkyl vinyl esters. *Mao*, for example, employs C₈₋₁₃ neoacid esters. However, not all these have homopolymeric Tg > 0°C. For example, α -branched C₉ carboxylic acids have a homopolymer Tg > 0°C (specification, page 3, lines 29-30). *Mao* does not provide any motivation to select, from among his C₈₋₁₃ vinyl esters, only those with a homopolymer

T_g < 0°C. If the Office disagrees, the portions of *Mao* which teach this selection should be identified.

Mao also teaches that the higher vinyl esters should substantially replace lower saturated esters such as vinyl acetate, while *Midgley* prefers such monomers. *Midgley* requires 60-99.5% of vinyl ester, while *Mao* teaches that his C₈₋₁₃ neoacid vinyl esters are present only in amounts of 40% or less.

The question of obviousness must be resolved against the background of the invention and the clear teachings of the prior art. The problem solved is highly relevant to this inquiry. In the case of *In re Shaffer*, 108 U.S.P.Q. 326 (C.C.P.A. 1956), the issue of obviousness over a combination of references was addressed by the C.C.P.A., the predecessor court to the C.A.F.C. In *Shaffer*, two references were combined by the Office in a rejection for obviousness. It was clear that between the two references, all the limitations of the claimed invention were present. However, the C.C.P.A. reversed the Board's affirmance of the rejection, since the claimed invention was directed to solving a problem which neither reference ever discussed. As the Court stated "a reference which does not discuss the problem cannot suggest a solution."

Here, the problem addressed is avoiding alkanol emissions by avoiding use of alkyl acrylate comonomers. *Midgley* does not discuss this problem. Moreover, all three of *Midgley's* polymers can contain alkyl acrylates. See *Midgley* at column 2, lines 65-68 (polymer (a));² column 2, lines 17-19 (polymer (b)); and column 2, lines 32-34 (polymer (c)). *Midgley* does not teach or suggest polymers must be free of alkyl esters, nor does *Midgley* even mention later generation of alkanols by hydrolysis.

Mao also does not discuss the problem of alkanol generation by hydrolysis. Moreover, the *Mao* compositions require from 30-80% alkyl acrylate, the very acrylates Applicants avoid.

² Polymer a) requires alkyl acrylates.

Viewing *Midgley* and *Mao*, what would the skilled artisan be directed to do, were he or she motivated to combine these references? Applicants believe that the respective teachings are so disparate that the skilled artisan would not be motivated to combine their teachings at all. However, the salient points of *Midgley*³ and *Mao* are to

Midgley: prepare a polymer of olefin, vinyl ester, and unsaturated carboxylic acid, followed by neutralization with strong base;

Mao: prepare a polymer of C₈₋₁₃ neoacid vinyl ester and alkyl (meth)acrylate.

Combining these references would, if anything, result in an ethylene, C₈₋₁₃ neoacid vinyl ester, alkyl acrylate, and unsaturated carboxylic acid copolymer, subsequently neutralized with strong base. There is no teaching or suggestion that either neutralization with strong base or presence of large quantities of alkyl (meth)acrylate should or could be avoided. This is not Applicants' invention. Withdrawal of the rejection of the claims over *Midgley* in view of *Mao* is solicited.

Graham is directed to adhesive compositions comprising an ethylene/unsaturated carboxylic acid copolymer ("interpolymer") and an acidic tackifier compatible therewith, which are then dispersed into water with the aid of strong base. *Graham* teaches that minor amounts of other monomers, including vinyl esters and alkyl acrylates may be used. However, *Graham* does not state any amounts of such optional comonomers, nor does he indicate that if vinyl esters are used, two distinct esters must be employed, one with high homopolymer Tg and one with low homopolymer Tg. *Graham* also requires the ethylene interpolymer to contain 15 weight percent to 24 weight percent of interpolymerized unsaturated carboxylic acids, (column 4, lines 53-54), and teaches that prior art ethylene/(meth)acrylic acid interpolymers containing low amounts of unsaturated carboxylic acid, i.e. 3-10%, are unacceptable in his composition (column 1, lines 51-68). The

³ Using polymer (c) as a point of reference.

ethylene/acrylic acid comparative copolymer in Table 1 contains 8% acrylic acid. *Graham* does not discuss emission of alkanol by hydrolysis of acrylates.

Again, Applicants find no evidence of motivation to combine *Graham* with *Mao*, for substantially the same reasons discussed earlier with *Midgley/Mao*. Here, however, there are additional reasons for lack of motivation to combine. The *Graham* application employs ethylene/acrylic acid copolymers with a large, required percentage of acrylic acid, and only an optional and minor quantity of alkyl acrylate. *Mao*, on the other hand, allows only up to 10% (meth)acrylic acid, a range which *Graham* states is insufficient in amount, and employs a major quantity of alkyl acrylate.

Even were combination proper, the resulting composition would be a tackifier-containing dispersion of an ethylene-based interpolymer containing in excess of 15% (meth)acrylic acid (*Graham*) and a major amount of alkyl acrylate (*Mao*). There would be very little, if any room for any vinyl ester in this composition, much less the large amount of vinyl acetate (high Tg) vinyl ester of the present invention. This high amount (20-80%) would cast serious doubt as to the compatibility with tackifiers, the entire focus of *Graham*.

Graham teaches that in excess of 15% (meth)acrylic acid is required, while Applicants use 10% or less. The combination of *Graham* and *Mao*, even if combinable, does not teach or suggest the subject composition, nor does either reference address the problem solved. *Shaffer, Id.* Withdrawal of the rejection over *Graham* in view of *Mao* is solicited.

Yoshii is directed to a method of increasing the water resistance of adhesives by including an acetoacetyl-group-containing polymerizable monomer and a protective colloid in an aqueous adhesive. In addition to the base ethylene and acetoacetyl monomers, *Yoshii* employs a vinyl ester monomer in large amounts (ethylene/vinyl ester/acetoacetyl monomer ratio is 5-70/100/0.1-10). *Yoshii* is silent about subsequent liberation of alkanols by hydrolysis, and even encourages use of alkyl (meth)acrylates (column 3, line 63 - column 4, line 6) in amounts of up to 20% by weight. Thus, *Yoshii* not only does not mention the

problem addressed by Applicants, he allows use of the very monomers which cause the problem, whose use is eschewed by Applicants.

Mao, as discussed previously, requires large amounts of alkyl (meth)acrylates. *Yoshii* allows such alkyl acrylates in amounts of up to 20 weight percent, while *Mao* requires 30-80 weight percent. These references are incompatible in this respect, therefore teaching against their combination. Moreover, the problems addressed are different. While *Yoshii* is directed to increasing water resistance, *Mao* is directed to providing adhesives which are aqueous emulsions rather than being solvent borne, and which exhibit stronger bonding to low energy surfaces. Applicants fail to find the requisite evidence supporting motivation to combine these references.

However, even if combined, the combination does not teach or suggest Applicants' invention. The various teachings of the references cannot be combined in isolation of the remaining teachings. *Wesslau, id.* *Mao* requires 30-80% alkyl (meth)acrylate, and does not teach or suggest how an adhesive could be made without this component. The use of alkyl (meth)acrylate is a salient feature of *Mao* which cannot be ignored.

Combination of *Mao* with the primary reference *Yoshii*, if anything, would motivate one skilled in the art to produce an adhesive employing ethylene, vinyl acetate, alkyl acrylate, a C₈₋₁₃ neoacid vinyl ester, and an acetoacetyl-group-containing monomer, in the presence of a colloidal stabilizer. These are the principle teachings of the references. However, such an adhesive is not within the scope of the present claims, as it contains the alkyl ester which the present invention expressly avoids, includes a colloidal stabilizer (per *Yoshii*) which is also excluded by the claim language as filed, and contains no suggestion to select both a high homopolymer Tg vinyl ester and a low homopolymer Tg vinyl ester.⁴ The combination of *Yoshii* with *Mao* does not teach or suggest the claimed invention. Withdrawal of the rejection of the claims over *Yoshii* in view of *Mao* is solicited.

⁴ Note that with respect even to the C₈₋₁₃ neoacid esters of *Mao*, not all these have homopolymer Tg < 0. VeoVa 9, for example, a C₉ acid vinyl ester has a homopolymer Tg > 0. See the present specification, page 3, last paragraph.

Claims 9-10 have been further rejected under 35 U.S.C. § 103(a) over *Yoshii* in view of *Mao*. Claims 9-10 are directed to adhesively bonding flooring materials and ceiling coverings employing the adhesive of the present invention. These types of applications are particularly critical since emissions of alkanol into the living space is particularly to be avoided.

While *Yoshii* in column 5 discloses that his adhesives are useful, *inter alia*, for floor materials, the adhesives *Yoshii* suggests are not those of Applicants. Moreover, as stated previously, were one to modify the adhesives of *Yoshii* in view of the teachings of *Mao*, one would use an adhesive containing large amounts of alkyl acrylates, required by *Mao*, and suggested also by *Yoshii*. The adhesive would not meet the subject claims, and would release alkanols over time by hydrolysis of the alkyl acrylate-derived groups of the polymer. This is contrary to the purpose of the present invention. Withdrawal of the rejections of claims 9 and 10 over the combination of *Yoshii* and *Mao* is solicited.

Applicants submit that the claims are now in condition for Allowance, and respectfully request a Notice to that effect. If the Examiner believes that further discussion will advance the prosecution of the Application, he is highly encouraged to telephone Applicants' attorney at the number given below.

Respectfully submitted,

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Attachment

VERSION WITH MARKINGS TO SHOW CHANGES MADE

1. A low-emission adhesive based on an aqueous, protective-colloid-free polymer dispersion or water-redispersible dispersion powders, obtainable therefrom, of vinyl [acetate] ester-ethylene copolymers containing free carboxylic acid groups, obtainable by free-radically initiated emulsion polymerization, in aqueous medium and in the presence of at least one emulsifier, of a comonomer mixture comprising

- a) from 5 to 50% by weight of ethylene,
- b) from 20 to 80% by weight of at least one vinyl ester selected from the group consisting of vinyl esters of unbranched or branched carboxylic acids having 1 to 9 carbon atoms whose homopolymers have a glass transition temperature $T_g > 0^\circ\text{C}$,
- c) from 5 to 70% by weight of at least one vinyl ester selected from the group consisting of a vinyl ester of a branched carboxylic acids having 8 to 13 carbon atoms whose homopolymers have a glass transition temperature $T_g < 0^\circ\text{C}$,
- d) from 0.5 to 10% by weight of at least one ethylenically unsaturated monocarboxylic or dicarboxylic acid having 3 or 4 carbon atoms,
- e) from 0 to 10% by weight of at least one ethylenically unsaturated, hydroxyalkyl-functional comonomer,
- f) from 0 to 10% by weight of a further mono- or polyethylenically unsaturated comonomer,

the % by weight being based in each case on the overall weight of the comonomers and adding up to 100% by weight, and the dispersion obtained therewith being dried if desired wherein said vinyl ester-ethylene copolymers are free of moieties derived from (meth)acrylate alkyl esters.

2. The low-emission adhesive as claimed in claim 1, wherein vinyl esters b) copolymerized are at least one member selected from the group consisting of vinyl acetate, vinyl propionate, vinyl butyrate, 1-methylvinyl acetate, vinyl pivalate, and vinyl esters of α -branched monocarboxylic acids having 9 carbon atoms.